

LISTING OF CLAIMS

- 1 1. (New) A liquid chemical delivery system for use with a supply container, comprising:
2
3 a controller;
4
5 a buffer reservoir with a chemical output, a main reservoir capable of receiving chemical
6 from the supply container, a reservoir valve connecting the buffer reservoir to the main
7 reservoir, a load cell coupled to the main reservoir and to the controller, operable to weigh the
8 liquid in the main reservoir;
9
10 a supply line having a valve coupled to the controller and to the supply container and to the
11 main reservoir;
12
13 means for delivering the liquid from the chemical output and refilling the main reservoir with
14 chemical when demanded by the controller based on signals from the load cell.

- 1 2. (New) The system of claim 1, wherein the means for delivering the liquid from the
2 chemical output and refilling the main reservoir includes a first gas line connected to the
3 buffer reservoir, a second gas line connected to the main reservoir, a gas source connected to
4 the first and second gas lines, a vacuum source, a vacuum line connecting the vacuum source
5 to the second gas line, a gas valve connecting the second gas line, the gas source, and the
6 vacuum source, wherein the controller opens the gas valve to permit gas to flow from the gas
7 source to the main reservoir when liquid is withdrawn from the main reservoir and to generate
8 a vacuum in the main reservoir when the reservoir is refilled from the supply container.

- 1 3. (New) The system of claim 1, wherein the controller closes the reservoir valve when the
2 main reservoir is refilled and liquid is delivered from the buffer reservoir such that the buffer
3 reservoir undergoes no negative pressure from the vacuum in the main reservoir.

- 1 4. (New) A liquid chemical delivery system for use with a supply container, comprising:

2

3 a controller;

4

5 a buffer reservoir with a chemical output, a main reservoir capable of receiving chemical
6 from the supply container, a reservoir valve connecting the buffer reservoir to the main
7 reservoir, a load cell coupled to the buffer reservoir and to the controller, operable to weigh
8 the liquid in the buffer reservoir;

9

10 a supply line having a valve coupled to the controller and to the supply container and to the
11 main reservoir;

12

13 means for delivering the liquid from the chemical output and refilling the main reservoir with
14 chemical when demanded by the controller based on signals from the load cell.

1 5. (New) The system of claim 4, wherein the means for delivering the liquid from the
2 chemical output and refilling the main reservoir includes a first gas line connected to the
3 buffer reservoir, a second gas line connected to the main reservoir, a gas source connected to
4 the first and the second gas lines, a vacuum source, a vacuum line connecting the vacuum
5 source to the second gas line, a gas valve connecting the second gas line, the gas source, and
6 the vacuum source, wherein the controller opens the gas valve to permit gas to flow from the
7 gas source to the main reservoir when liquid is withdrawn from the main reservoir and to
8 generate a vacuum in the main reservoir when the main reservoir is refilled from the supply
9 container.

1 6. (New) The system of claim 4, wherein the controller closes the reservoir valve when the
2 main reservoir is refilled and liquid is delivered from the buffer reservoir such that the buffer
3 reservoir undergoes no negative pressure from the vacuum in the main reservoir.

1 7. (New) A liquid chemical delivery system for use with a supply container, comprising:

2

3 a controller;

4

5 a buffer reservoir with a chemical output, a main reservoir capable of receiving chemical
6 from the supply container, a reservoir valve connecting the buffer reservoir to the main
7 reservoir, a first load cell coupled to the main reservoir and to the controller, operable to
8 weigh the liquid in the main reservoir; a second load cell coupled to the buffer reservoir and
9 to the controller, operable to weigh the liquid in the buffer reservoir,
10 a supply line having a valve coupled to the controller and to the supply container and to the
11 main reservoir;

12

13 means for delivering the liquid from the chemical output and refilling the main reservoir with
14 chemical when demanded by the controller based on signals from the first and the second
15 load cells.

1 8. (New) The system of claim 7, wherein the means for delivering the liquid from the
2 chemical output and refilling the main reservoir includes a first gas line connected to the
3 buffer reservoir, a second gas line connected to the main reservoir, a gas source connected to
4 the first and second gas lines, a vacuum source, a vacuum line connecting the vacuum source
5 to the second gas line, a gas valve connecting the second gas line, the gas source, and the
6 vacuum source, wherein the controller opens the gas valve to permit gas to flow from the gas
7 source to the main reservoir when liquid is withdrawn from the main reservoir and to generate
8 a vacuum in the main reservoir when the main reservoir is refilled from the supply container.

1 9. (New) The system of claim 7, wherein the controller closes the reservoir valve when the
2 main reservoir is refilled and liquid is delivered from the buffer reservoir such that the buffer
3 reservoir undergoes no negative pressure from the vacuum in the main reservoir.

1 10. (New) A liquid chemical delivery system comprising:

2

3 a) an upstream delivery system portion comprising a main reservoir for containing the
4 liquid chemical and a first measuring means for measuring the amount of liquid chemical
5 contained therein;

6

7 b) a downstream delivery system portion comprising a buffer reservoir having an
8 optional second measuring means located intermediate the main reservoir and a delivery site
9 and for receiving the liquid chemical from the main reservoir and delivering the liquid
10 chemical to the delivery site; and

11

12 c) control means for precisely controlling the flow of the liquid chemical from the main
13 reservoir to the delivery site.

1 11. (New) The liquid chemical delivery system of claim 10 further comprising first delivery
2 means for delivering the liquid chemical from the delivery site so that a target may receive a
3 preselected amount of the liquid chemical.

1 12. (New) The liquid chemical delivery system of claim 10 wherein the flow of the liquid
2 chemical from the main reservoir to the delivery site is continuous.

1 13. (New) The liquid chemical delivery system of claim 10 wherein the control means
2 comprises first pressure regulation means for regulating a pressure condition in the buffer
3 reservoir sufficient to deliver the liquid chemical to the delivery site in said controlled
4 manner.

1 14. (New) The liquid chemical delivery system of claim 13 wherein the control means
2 comprises second pressure regulating means for regulating a pressure condition in the main
3 reservoir for delivering the liquid chemical to the delivery site in cooperation with the first
4 pressure regulating means in said controlled manner.

1 15. (New) The liquid chemical delivery system of claim 12 wherein the flow of the liquid
2 chemical to the target is constant.

1 16. (New) The liquid chemical delivery system of claim 13 wherein the pressure condition in
2 the buffer reservoir is a constant pressure.

- 1 17. (New) The liquid chemical delivery system of claim 13 wherein the first pressure
2 regulating means comprises sealing means for sealing the downstream delivery system
3 portion from the upstream delivery system portion.

- 1 18. (New) The liquid chemical delivery system of claim 10 wherein the upstream delivery
2 system portion comprises main reservoir refill means for refilling the main reservoir while the
3 liquid chemical is being delivered to the delivery site.

- 1 19. (New) The liquid chemical delivery system of claim 14 wherein the first and second
2 measuring means is at least one load cell.

- 1 20. (New) The liquid chemical delivery system of claim 19 wherein the control means
2 comprises signal generating means for generating a first signal corresponding to the amount
3 of liquid chemical measured by the load cell, and signal detecting means for detecting the first
4 signal and generating a second signal therefrom for operating the first and second pressure
5 regulating means.

- 1 21. (New) The liquid chemical delivery system of claim 13 wherein the first pressure
2 regulating means comprises first gas supply means for supplying a gas to the buffer reservoir.

- 1 22. (New) The liquid chemical delivery system of claim 14 wherein the second pressure
2 regulating means comprises second gas supply means for supplying a gas to the main
3 reservoir.

- 1 23. (New) The liquid chemical delivery system of claim 10 further comprising means for
2 identifying trends in chemical usage based on the amount of liquid chemical delivered from
3 the main reservoir.

- 1 24. (New) The liquid chemical delivery system of claim 19 wherein the at least one load cell
2 is operatively connected to at least one of the main reservoir and the buffer reservoir.

- 1 25. (New) The liquid chemical delivery of claim 24 wherein a load cell is operatively
2 connected to the main reservoir.

1 26. (New) The liquid chemical delivery system of claim 19 wherein the control means
2 maintains the weight of chemical in the buffer reservoir while the amount of liquid chemical
3 in the main reservoir decreases to a predetermined amount, said control means comprising
4 main reservoir refill means for initiating refill of the main reservoir when the liquid chemical
5 in the main reservoir reaches the predetermined amount.

1 27. (New) A liquid chemical delivery system comprising:
2
3 a multi-reservoir load cell assembly, including a main reservoir, a buffer reservoir, and a load
4 cell;
5
6 a logic device coupled to the load cell(s) providing output signals to actuate:
7
8 means for sealing and unsealing the buffer reservoir from the main reservoir wherein sealing
9 corresponds to a first mode of operation of refilling the main reservoir and wherein unsealing
10 corresponds to a second mode of operation of not refilling the main reservoir, and
11
12 a gas source supplying the main reservoir to blanket the liquid chemical in the main reservoir.

1 28. (New) A liquid chemical delivery system, comprising:
2
3 a multi-reservoir load cell assembly, including a main reservoir with a load cell;
4
5 a buffer reservoir;
6
7 means for sealing and unsealing the buffer reservoir from the main reservoir;
8
9 means for receiving a first liquid chemical in the main reservoir until the multi-reservoir load
10 cell assembly determines the main reservoir has a sufficient amount of the first liquid
11 chemical;
12
13 means for receiving a second liquid chemical in the main reservoir until the multi-reservoir

14 load cell assembly determines the main reservoir has a sufficient amount of the second liquid
15 chemical; and
16
17 wherein the system is adapted to transport the first liquid chemical and the second liquid
18 chemical from the main reservoir to the buffer reservoir.

1 29. (New) A liquid chemical delivery system for use with a supply container, comprising:
2
3 a controller;
4
5 a multi-reservoir load cell assembly, including, a buffer reservoir with a chemical output, a
6 main reservoir in fluid communication with the buffer reservoir, and a load cell, coupled to
7 the assembly and to the controller, operable to weigh the liquid in the reservoir assembly;
8
9 a supply line having a valve coupled to the controller and to the supply container and to the
10 main reservoir; and
11
12 means for delivering the liquid from the chemical output and refilling the main reservoir from
13 the supply container when demanded by the controller based on signals from the load cell.

1 30. (New) The system of claim 29, wherein the means for delivering the liquid from the
2 chemical output and refilling the main reservoir from the supply container includes a gas line
3 connected to the main reservoir, a gas source connected to the gas line, a vacuum source, a
4 vacuum line connecting the vacuum source to the gas line, a gas valve connecting the gas
5 line, the gas source, and the vacuum source, wherein the controller opens the gas valve to
6 permit gas to flow from the gas source to the main reservoir when liquid is withdrawn from
7 the main reservoir and to generate a vacuum in the main reservoir when the main reservoir is
8 refilled from the supply container.

1 31. (New) The system of claim 29, further including a reservoir valve connecting the buffer
2 reservoir to the main reservoir for opening and closing fluid communication between the
3 main reservoir and the buffer reservoir, and wherein the controller closes the reservoir valve

4 when the main reservoir is refilled and liquid is delivered from the chemical output such that
5 the buffer reservoir undergoes no negative pressure from a vacuum in the main reservoir.

1 32. (New) A chemical delivery system, comprising:

2
3 a multi-reservoir load cell assembly comprising a main reservoir capable of fluid
4 communication with a buffer reservoir and a first load cell weighing the assembly and
5 generating an output signal indicative of the weight; and

6
7 means, responsive to the output signal, for adjusting the pressure in the main reservoir and in
8 the buffer reservoir and for calculating the amount of chemical in the assembly.

1 33. (New) The system of claim 32 wherein the means responsive to the output signal further
2 includes controlling fluid communication between the main reservoir and the buffer reservoir.

1 34. The system of claim 33, wherein the first load cell generates an output signal proportional
2 to the weight of the chemical in the main reservoir.

1 35. (New) The system of claim 32 wherein the first load cell generates an output signal
2 proportional to the weight of the chemical in the main reservoir.

1 36. (New) The system of claim 33, wherein the first load cell generates an output signal
2 proportional to the weight of the chemical in the buffer reservoir.

1 37. (New) The system of claim 32 wherein the first load cell generates an output signal
2 proportional to the weight of the chemical in the buffer reservoir.

1 38. (New) The system of claim 33, wherein the means responsive to the output signal
2 includes means for refill of the assembly with the chemical when the weight of chemical
3 drops to a predetermined amount by the following sequence:

4
5 a) isolating the main reservoir from fluid communication with the buffer reservoir,
6

7 b) reducing the gas pressure in the main reservoir to draw the chemical into the main reservoir
8 until the chemical rises to a predetermined amount,

9

10 c) increasing the gas pressure in the main reservoir, and

11

12 d) opening fluid communication between the main reservoir and the buffer reservoir to allow
13 the chemical in the main reservoir to flow into the buffer reservoir.

1 39. (New) The system of claim 34, wherein the means responsive to the output signal
2 includes means for refill of the assembly with the chemical when the weight of chemical
3 drops to a predetermined amount by the following sequence:

4

5 a) isolating the main reservoir from the buffer reservoir,

6

7 b) reducing the gas pressure in the main reservoir to draw the chemical into the main reservoir
8 until the chemical rises to a predetermined amount,

9

10 c) increasing the gas pressure in the main reservoir, and

11

12 d) opening communication between the main reservoir and the buffer reservoir to allow the
13 chemical in the main reservoir to flow into the buffer reservoir.

1 40. (New) The system of claim 36, wherein the means responsive to the output signal
2 includes means for refill of the assembly with the chemical when the weight of chemical
3 drops to a predetermined amount by the following sequence:

4

5 a) isolating the main reservoir from the buffer reservoir,

6

7 b) reducing the gas pressure in the main reservoir to draw the chemical into the main reservoir
8 until the chemical rises to a predetermined amount,

9

10 c) increasing the gas pressure in the main reservoir, and

11

12 d) opening communication between the main reservoir and the buffer reservoir to allow the
13 chemical in the main reservoir to flow into the buffer reservoir.

1 41. (New) A liquid chemical delivery system, comprising:

2
3 a multi-reservoir load cell assembly, including a main reservoir with a gas inlet, a liquid inlet,
4 and a liquid outlet, and a buffer reservoir with a gas inlet and a liquid inlet;

5
6 at least one load cell to weigh the chemical contained in the assembly and generate an output
7 signal indicative of the weight;

8
9 a valve connecting the main reservoir liquid outlet and the buffer reservoir liquid inlet;

10
11 a valve connecting the main reservoir gas inlet and the buffer reservoir gas inlet;

12
13 means, responsive to the output signal, for refilling the buffer reservoir with chemical when
14 the output signal indicates chemical in the buffer reservoir has dropped to a predetermined
15 level, comprising:

16
17 closing the valve connecting the main reservoir liquid outlet and the buffer reservoir liquid
18 inlet to isolate the main reservoir from fluid communication with the buffer reservoir,

19
20 opening the valve connecting the main reservoir gas inlet and the buffer reservoir gas inlet to
21 evacuate the main reservoir to draw liquid chemical into the main reservoir until the liquid
22 chemical rises to a predetermined level,

23
24 opening the valve connecting the main reservoir liquid outlet and the buffer reservoir liquid
25 inlet to allow the liquid chemical in the main reservoir to flow into the buffer reservoir.

1 42. (New) A liquid chemical delivery system for use with a chemical supply source,
2 comprising:

3
4 a multi-reservoir load cell assembly, including a main reservoir, a buffer reservoir, and at

5 least one load cell;
6
7 a logic device coupled to the load cell providing output signals to actuate:
8
9 means for sealing and unsealing the buffer reservoir from the main reservoir,
10
11 a vacuum generator for evacuating the main reservoir to draw liquid chemical from the
12 chemical supply source into the main reservoir, and
13
14 a gas pressure source to pressurize the main reservoir .

1 43. (New) The system of claim 42, wherein the means for sealing and unsealing includes a
2 shaft or valve disposed between the main reservoir from the buffer reservoir.

1 44. (New) The system of claim 42, wherein the at least one load cell comprises a first load
2 cell and a second load cell generating first signals and second signals indicating the weight of
3 the main reservoir and the buffer reservoir to the logic device.

1 45. (New) The system of claim 42, wherein the logic device monitors the weight of the buffer
2 reservoir so that if the rate of liquid chemical consumption will empty the buffer reservoir
3 before the refill is complete, the system can stop refill and/or transport liquid chemical from
4 the main reservoir to the buffer reservoir to prevent emptying the buffer reservoir.

1 46. (New) The system of claim 42, further comprising means for flexibly connecting the
2 buffer reservoir to a main valve at the main reservoir and suspending the buffer reservoir
3 from the main reservoir.

1 47. (New) The system of claim 44, further comprising means for starting refill when the
2 second load cell detects the weight of the buffer reservoir is decreasing.

1 48. (New) A system for combining a first liquid chemical and a second liquid chemical, and
2 delivering the combination, comprising:
3

4 a multi-reservoir load cell assembly, including a main reservoir with a load cell;

5

6 a buffer reservoir;

7

8 means for sealing and unsealing the buffer reservoir from the main reservoir;

9

10 means for supplying a first liquid chemical to the main reservoir until the multi-reservoir load

11 cell assembly determines the main reservoir has a sufficient amount of the first liquid

12 chemical;

13

14 means for supplying a second liquid chemical to the main reservoir until the multi-reservoir

15 load cell assembly determines the main reservoir has a sufficient amount of the second liquid

16 chemical; and

17

18 wherein the system is adapted to transport the combination of the first liquid chemical and the

19 second liquid chemical from the main reservoir to the buffer reservoir.